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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/821,404	03/29/2001	Ellen M. Eide	YOR20010072US1 (590.044)	3580
35195	7590	08/19/2005	EXAMINER WOZNIAK, JAMES S	
FERENCE & ASSOCIATES 409 BROAD STREET PITTSBURGH, PA 15143			ART UNIT 2655	PAPER NUMBER

DATE MAILED: 08/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/821,404

Applicant(s)

EIDE, ELLEN M.

Examiner

James S. Wozniak

Art Unit

2655

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on 15 June 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Amendment*

1. In response to the office action from 2/15/2005, the applicant has submitted an amendment, filed 6/15/2005, arguing to traverse the art rejection based on the limitation regarding the rebuilding of a speech model for each of a pre-selected number of linguistic features (*Amendment, Pages 8-9*). Applicant's arguments have been fully considered, however the previous rejection is maintained due to the reasons listed below in the response to arguments.

### *Response to Arguments*

2. Applicant's arguments have been fully considered but they are not persuasive for the following reasons:

With respect to **Claims 1, 13, and 25**, the applicant argues that De Souza et al (U.S. Patent: 5,884,261) fails to teach rebuilding a speech model for ranked linguistic features (*Amendment, Page 9*), however the examiner notes that it is the combination of Nouza ("Feature Selection Methods for Hidden Markov Model-based Speech Recognition"), Eide et al ("A Linguistic Feature Representation of the speech Waveform," 1993) and De Souza that teaches this feature.

Nouza provides the teachings of obtaining speech data and building a model for each for feature of an original set of speech features (*Page 187, Col. 1, Lines 5-9; Page 188, Col. 1, Lines*

5-13; and *Prior office action, Page 3*). Nouza also teaches a means for ranking speech features (*Page 188, Col. 1, last paragraph- Col. 2, first paragraph*). Nouza is deficient in the specific teachings of the use of linguistic features in describing speech and rebuilding a speech model for a number of ranked linguistic features. The inclusion of Eide provides the teaching of the use of linguistic speech features (*Pages 483-484, Section 1; and Table 1*) in place of the speech features disclosed by Nouza for the benefit of improving speech recognition accuracy through contextual information provided by linguistic features (*Page 485-486, Section 3; and Table 5*).

Nouza in view of Eide is deficient in the specific teachings of rebuilding a speech model for ranked features, however the examiner points out that Nouza does note the importance of reducing the size of an original HMM model by utilizing ranked features, which would require a necessary step of original model rebuilding for the ranked features (*Nouza, HMM simplification, Page 190, Section 7*). Additionally, De Souza specifically teaches rebuilding a Markov model by replacing original model features with features that have a highest likelihood of an acoustic match (*Col. 16, Lines 15-59*) for the benefit of creating updated models which best represent speech feature data (*Col. 16, Lines 38-42*). The process of replacing portions of the Markov speech model taught by De Souza is the equivalent of rebuilding a speech model for ranked features in the present invention, since the determination of the highest likelihood of an acoustic match in De Souza would require feature ranking (which is also taught by Nouza as noted above). Eide discloses the specific use of linguistic features, and when taken in combination with Nouza and De Souza, teaches the limitation regarding the rebuilding of a speech model for ranked linguistic features.

The dependent claims are argued as further limiting rejected independent claims (*Amendment, Page 10*), and thus, also remain rejected.

Also, the applicant has not officially challenged the official notice taken with respect to claim 25 regarding the use of a computer readable medium in any of the prior office actions, thereby making the use of such a medium the applicant's admitted prior art.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1- 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouza (*"Feature Selection Methods for Hidden Markov Model-based Speech Recognition"*) in view of Eide et al (*"A Linguistic Feature Representation of the Speech Waveform," 1993*), and further in view of De Souza et al (*U.S. Patent: 5,884,261*).

With respect to **Claims 1 and 13**, Nouza recites:

Obtaining speech input data (*HMM and DTW speech recognition systems, Page 188, Col. 1, Lines 5-7; Inherently, speech data would have to be received in order for speech to be recognized by the recognition system.*);

Building a model for each feature of an original set of features (*parameters used to distinguish models of different speech objects in the form of Gaussian mixture pdfs, Page 187,*

*Col. 1, Lines 5-9, and evaluated for individual feature contributions for speech unit classification, Page 188, Col. 1, Lines 11-13);*

Ranking the features (*feature significance factor that can be used for ordering features, Page 188, Col. 1, last paragraph – Col. 2, first paragraph*);

Nouza does not teach the use of linguistic features in building speech models for recognition, however, Eide discloses a method for creating speech recognition models using speech features that have been linguistically classified (*Pages 483-484, Section 1, and Table 1*).

Nouza and Eide are analogous art because they are from a similar field of endeavor in speech recognition feature processing. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the use of linguistic features in the creation of a speech model for recognition as taught by Eide with the speech recognition system utilizing feature selection as taught by Nouza to improve recognition accuracy through contextual information provided by linguistic features, thus implementing a means of keyword spotting (*Eide, Page 485-486, Section 3 and Table 5*).

Neither Nouza nor Eide explicitly teach the additional step of rebuilding the model for each of a preselected number of ranked features, however De Souza discloses a means for updating speech recognition model arcs utilizing speech features having a highest likelihood of an acoustic match (*Col. 16, Lines 15-59*).

Nouza, Eide, and De Souza are analogous art because they are from a similar field of endeavor in speech recognition feature processing. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to modify the teachings of Nouza in view of Eide with the ability to rebuild speech recognition model arcs utilizing speech features having a

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highest likelihood of an acoustic match as taught by De Souza in order to implement more accurate speech recognition by creating updated models which best represent speech feature data (*De Souza, Col. 16, Lines 38-42*).

With respect to **Claims 2 and 14**, Nouza further discloses:

The method and apparatus according to claims 1 and 13, respectively, wherein said step of building a model for each of a pre-selected number N of the ranked features comprises building a model for the top N ranked features (*reducing the size of feature vectors used in speech processing, Abstract, Lines 5-6, feature significance factor that can be used for ordering features, Page 188, Col. 1, last paragraph – Col. 2, first paragraph, and identifying correct and incorrect speech models based upon those features, Page 188, Lines 26-32. It would be inherent, upon selection of principal components with the largest amount of variance from an ordered component set used for separating hypothesis choices, that the principal component features being of a highest likelihood to represent a particular state within a HMM be used to remodel a most likely HMM candidate for speech recognition.*)

With respect to **Claims 3 and 15**, Nouza additionally recites:

The method and apparatus according to claims 1 and 13, respectively, further comprising the step of compiling a confusion matrix for each feature of the original set of features subsequent to said step of building a model for each feature of an original set of features (*covariance matrix used to evaluate the contributions of a feature in speech classification and to determine whether a particular speech model is correct or incorrect, Page 188, Col. 1, Lines 11-32*).

With respect to **Claims 4, 5, 16, and 17**, Nouza further discloses:

The method and apparatus according to claims 3 and 15 and claims 4 and 16, respectively, wherein said step of compiling a confusion matrix comprises computing a score for each feature based on the likelihood, as a log-likelihood as per Claim 5, of its presence in a frame of the speech input data (*contribution of a feature within a covariance matrix in identifying a speech unit using a particular speech model, which is represented by a log-likelihood score, Page 188, Col. 1, Lines 13-23*).

With respect to **Claim 6 and 18**, Nouza teaches the method and system of feature selection in recognizing a speech unit, utilizing a confusion matrix used to evaluate the contributions of a feature in speech classification and to determine whether a particular speech model is correct or incorrect as applied to Claims 3 and 15, while De Souza teaches the means of rebuilding speech recognition model arcs utilizing speech features having a highest likelihood of an acoustic match, as applied to Claims 1 and 13. Neither Nouza nor De Souza specifically teaches comparing likelihood scores to a predetermined threshold as a means of detecting whether a speech feature is useful in picking a correct classification however, Eide discloses:

Compiling a confusion matrix further comprises comparing each score of each feature with a threshold (*detection of a particular linguistic feature within a phoneme that would inherently require some type of threshold comparison to determine the presence of such a feature, Pages 484-484, Section 1 and Tables 1-4*).

Nouza, Eide, and De Souza are analogous art because they are from a similar field of endeavor in speech recognition feature processing. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to modify the teachings of Nouza and De Souza with the use of a threshold comparison in determining the presence of a particular



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linguistic feature within a phoneme as suggested by Eide to provide a well-known and convenient means of detecting if a linguistic feature is present in picking a correct phoneme classification through threshold comparison. Therefore, it would have been obvious to combine Eide, Nouza, and De Souza for the benefit of detecting the presence of a particular linguistic feature for phoneme classification.

With respect to **Claims 7 and 19**, Eide additionally discloses:

Calculating mutual information between truth and labels for each feature (*determination of the absence or presence of a particular speech feature designated by a "+" or "-" in phoneme classification, Pages 483-484, Section 1, and Tables 1-4*).

With respect to **Claims 8 and 20**, Eide further recites:

Ranking the mutual information calculated in compiling the confusion matrix (*determination of the most-likely linguistic classes used to describe a phoneme, which would inherently require a step of linguistic feature ranking, Pages 483-484, and Tables 1-4*).

With respect to **Claims 9, 11, 21, and 23**, Eide additionally recites:

Partitioning the speech input data in parallel, once for each linguistic feature (*dividing speech training data according to linguistic feature truth labels, Page 483, Section 1*); and

Producing an observation vector (*calculating attribute vectors, Page 483, Section 1*).

With respect to **Claims 10, 12, 22, and 24**, Eide further discloses:

Portioning data in parallel from the observation vector, once for each feature (*dividing attribute vectors into feature-present and feature-absent sets for all linguistic features, Page 484, Section 1*); and

Producing final observations (*final determination of whether a particular linguistic feature is present or absent in speech training data, Page 484, Section 1*).

5. **Claim 25** is rejected under 35 U.S.C. 103(a) as being unpatentable over Nouza ("*Feature Selection Methods for Hidden Markov Model-based Speech Recognition*") in view of Eide et al ("*A Linguistic Feature Representation of the Speech Waveform*," 1993), further in view of De Souza et al (*U.S. Patent: 5,884,261*), and yet further in view of the applicant's admitted prior art.

With respect to **Claim 25**, Nouza in view of Eide, and in further view of De Souza teaches the method of linguistic feature selection in building a speech recognition unit as applied to Claim 1. While Nouza in view of Eide, and in further view of De Souza, does not teach it, it is the applicant's admitted prior art to implement the method taught by Nouza in view of Eide using a computer program contained on a computer storage device, since computers are conveniently used and their programs easily updated for performing speech recognition operations, while a storage device would offer a means of storing any training databases or other necessary stored information. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of invention, to implement a linguistic feature selection method for recognition model building using a computer program transferable between various machines through the use of a storage device, thus increasing method adaptability, to obtain the invention as specified in Claim 25.

***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Jiang et al (*U.S. Patent: 6,542,866*)- teaches a means for ranking speech features for the determination which features best represent speech, which utilizes acoustic models for each linguistic unit of a language.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to James S. Wozniak whose telephone number is (571) 272-7632

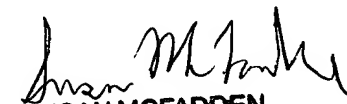
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and email is James.Wozniak@uspto.gov. The examiner can normally be reached on Mondays-Fridays, 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wayne Young can be reached at (571) 272-7582. The fax/phone number for the Technology Center 2600 where this application is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the technology center receptionist whose telephone number is (703) 306-0377.

James S. Wozniak  
7/22/2005

  
SUSAN MCFADDEN  
PRIMARY EXAMINER